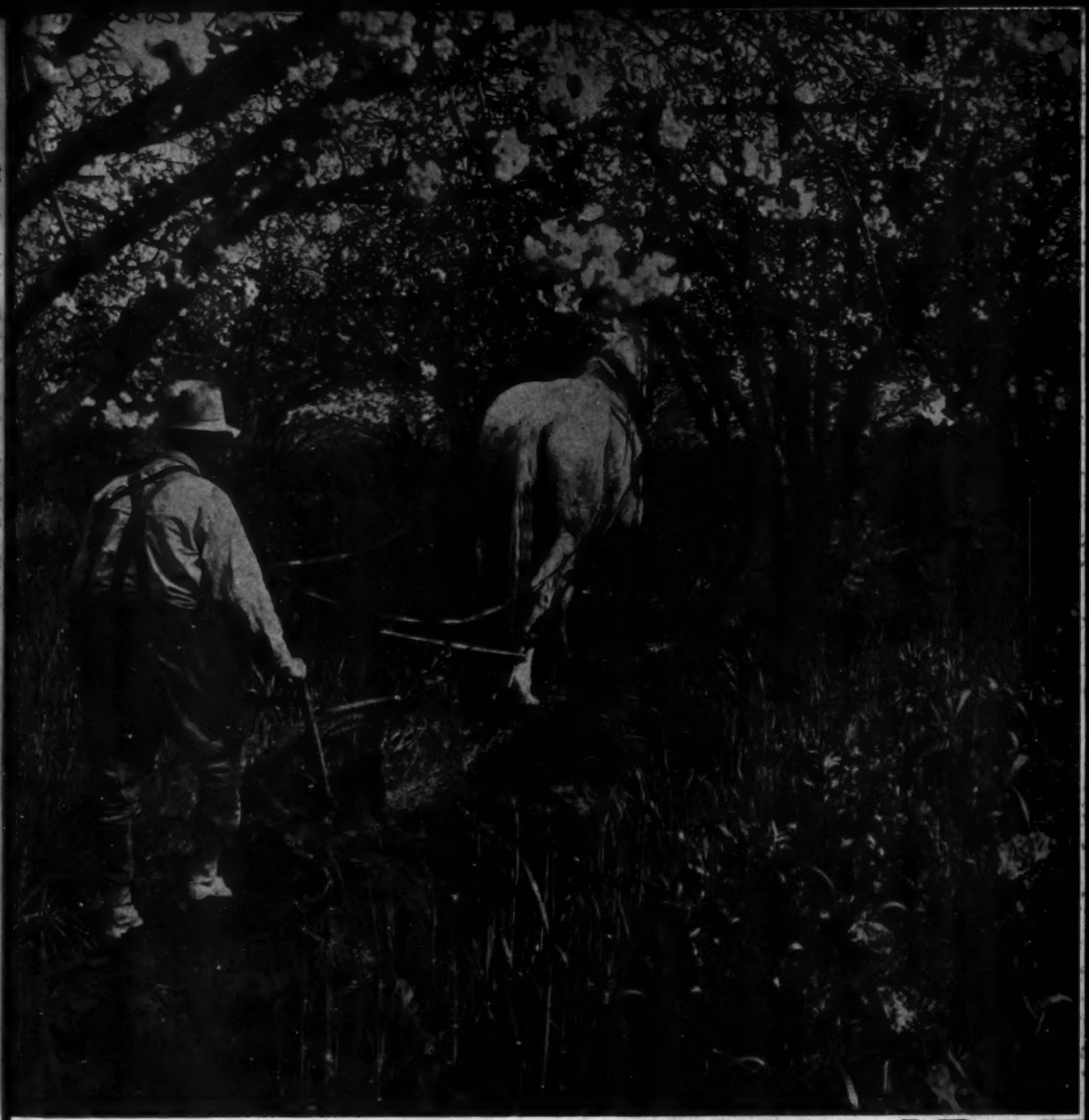

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SOIL CONSERVATION

OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE

TED STATES DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C

SOIL CONSERVATION

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WELLINGTON BRINK EDITOR

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Front Cover: April orchard scene in Sonoma County, Cal. This method of cultivation is a far cry from that used in modern commercial orchards. Photographer: J. T. Allison.

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INCREASED GAINS AND PROFITS THROUGH GOOD PASTURES

Well-sodded buffalo grass pasture and flock of grazing sheep on Steve Blaser farm near Stillwater. Buffalo grass has been held over the dry summer on the lower parts of this pasture by placing small dams in the creek, thereby forcing water to spread over the grass.

By HI W. STATEN

The 1940 agricultural census of Oklahoma lists 34,803,317 acres of land in farms. Slightly over 50 percent of this acreage can be classified as land used for pasture. Approximately 14 million acres are planted to cultivated crops each year and about 75 percent of these crops are used for the purpose of growing feed for livestock.

The position which pastures occupy in the agriculture of Oklahoma is changing as our state grows older. In the pioneer stage when there was an abundance of land, much of it was not utilized and pastures existed as an open range without regard to the quality of the land producing that pasture. As the state became settled and divided up into farms, each operator was confronted with the necessity of deciding whether the various acres within his farm should be regarded as arable land or pasture and woodland. These judgments are always exercised, sometimes well and sometimes badly. As time passed and new generations came, much of the best land was planted to clean-cultivated crops and the process of soil depletion began. Sometimes management revealed a very complete regard for the factor of depletion, but more often crops were harvested and fed or sold without regard to the maintenance of the productivity of the land. Thus, year after year, yields of our cultivated acres have declined and now we find in the State of Oklahoma approximately 2½ million acres of our one time fertile soil have been worn out and are now in the stage of abandonment. Three to four million additional acres are in a state of dangerous submarginal condition. One county which I have in mind produced 20 years ago around 40,000 bales of cotton annually but now produces only 7 to 8 thousand bales.

I believe the present trend of the thinking in Oklahoma is toward a better land use which, of course, must include soil fertility, erosion control and more and better pastures.

Good pastures, either native or tame, are the cheapest feed one can give to livestock. This factual statement cannot be challenged in any section of our country. The Kansas Experiment Station proves this statement in Bulletin 272.

Editor's Note.—The author is in charge of pasture and grass investigations Oklahoma A.&M. College Experiment Station, Stillwater, Okla.

Cost of livestock nutrients from pasture and other crops:

Crop	Yield per acre	Cost of 100 pounds of digestible nutrients
Tame pasture mixture	2 tons	10.4 cents
Alfalfa hay	2½ tons	25.8 cents
Barley	20 bushels	51.8 cents
Corn	20 bushels	64.3 cents
Oats	23 bushels	76.3 cents

Pasture costs include use of land, seeding, fertilizers, preparation of seedbed and fencing so the area could be used for rotation pastures.

Figures collected by the United States Department of Agriculture in 16 states show that for each 100 pounds of digestible nutrients obtained from pasture, the cost was $.64; for alfalfa hay, $.83; for corn, $1.38, for corn silage, $1.54; and for oats, $2.02. These costs represent average conditions rather than specific examples. The above data show conclusively that pasture is the cheapest feed that can be grown on the farm for any kind of livestock. It is hard to realize the large amount of pasture grass which is necessary to feed an animal for a day. A mature cow will consume, under favorable conditions, 100 pounds or more of green feed in a day. This task must be accomplished with a 3-inch mower. A cow should spend about 8 of the 24 hours in actual grazing; the remaining 16 hours should be spent resting and chewing her cud. The cow is a very efficient "hay baler" and, of course, saves considerable labor and cost of providing feed through the year.

It must not be concluded that pastures will solve the entire feed problem. Good hay, silage and concentrates must be provided for the purpose of keeping the animal up to peak production and to take care of droughts and other unfavorable seasonal conditions.

Oklahoma Experiment Station Circular C-116, "Crop Calendars for a Year-Round Pasture Program," explains and illustrates ways and means of developing year-round green pasture schedules for the eastern, central and western parts of the state. The native pasture lands of Oklahoma are often thought of as having low productivity. This is because the pastures, as a general rule, are located on the poorest land of the farm. Where equally as good land is used for pasture as for other crops, the net income is as much or more than from cultivated crops and a wiser safer land use policy is adopted.

The fertility of our soils, particularly organic matter and minerals (calcium and phosphate), must be given serious consideration in the central and eastern part of our state in building and revitalizing our pastures. There are exceptions, particularly in the Arbuckle and Osage regions where sufficient minerals are available. The soils of the western part of the state contain sufficient min-

THE AUTHOR OF THIS ARTICLE SAYS—

1. Good pastures are the cheapest feeds one can provide for all classes of livestock. A much greater area of our cultivated land which is in the submarginal stage should be removed from cultivation and rededicated to pastures for the most effective and efficient land use policy. It is not unreasonable to conclude that more than 20 million acres of our farm land should be in pasture.

2. Management of our already existing pastures, particularly proper stocking, weed-mowing, non-burning, resting and rotation-grazing to allow reseeding, is worthy of major consideration in increasing gains and profits of livestock in Oklahoma.

3. Soil fertility, with emphasis on the mineral program in central and eastern Oklahoma should be stressed.

4. Better than 75 percent of the agricultural land in Oklahoma is used directly or indirectly for livestock production. This means that the end-product of the agriculture in Oklahoma is and should be livestock. Since more than 50 percent of our agricultural land is used for pastures, and through pastures we can produce our greatest and most economic gains and profits, our pastures should be No. 1 on our program for better agriculture in Oklahoma. This is especially true at the present time because of the historical number of livestock on our farms and ranches; the need for livestock products to help win this war; the need for a more stabilized agriculture in the postwar period; the need for a more stable and sound land-use policy; and particularly in view of the fact that our pastures are on the downgrade in production. The trend of pasture condition should be leveled off and started on the upgrade. This can be done by cooperatively planning a sound land-use program in Oklahoma.

Winter small grains and annual rye grass are tested at the Oklahoma Experiment Station for forage yield and suitability for pasture.

erals for fine grass production, but supplementary pastures should be provided for the purpose of lengthening the grazing season, relieving the load from the already overgrazed native pastures and reducing feeding costs.

The native pastures of central and eastern Oklahoma are badly overgrazed and weedy. They do not provide good grazing for longer than 4 to 5 months of each year. During the other months livestock must be dry-fed or additional pastures made. It is easy to provide these additional pastures through the use of Bermuda grass, ryegrass, small grains (wheat, oats, rye and barley), Korean lespedeza and hop clover planted in the small grains, and other grass and legume crops, namely sweet clover, black medic, bur clover, white Dutch, ladino clover, etc.

For example, a few acres of Bermuda grass with lespedeza, a summer-growing legume, and yellow hop, white Dutch, black medic or bur clover, all of which are winter legumes, added to the permanent Bermuda pasture will provide fine grazing for 8 to 9 months of the year. The carrying capacity of this kind of a pasture often is 1 mature animal to each acre. Income in beef per acre has been measured in many sections of the eastern part of Oklahoma and Arkansas, and it has been found that a good Bermuda-legume pasture which has sufficient soil minerals will produce 300 to 400 pounds of beef annually. Winter small grains or ryegrass with hop clover or Korean lespedeza make a fine supplemental pasture which adds several months to the grazing schedule. Records show that such a pasture will produce 150 to 200 pounds of beef per acre through the grazing season. A pure stand of grasses, either native or tame, in central and eastern Oklahoma is not sufficient. The high protein content of grasses does not last much longer than 2½ to 3 months, but when a legume is added the high protein content of the forage can be extended through the entire growing season. Therefore, it is very important that wherever possible a legume should be added to a grass pasture.

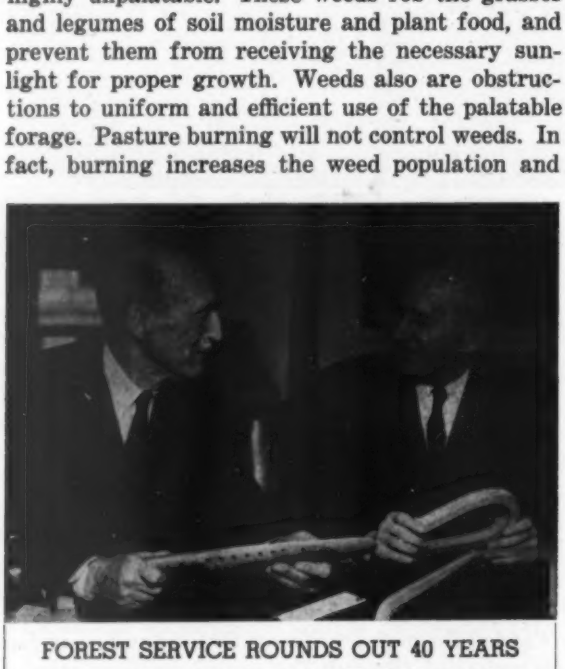
The native grass pastures of the western section are well supplied with plant nutrients, particularly minerals, and the nutritive value of the grasses is very high throughout the year. This is largely due to the high mineral soils, the low rainfall and the native grass species common to the west. Buffalo and blue grama species are predominant in this part of the state and are classed as hard-

stemmed grasses. These hard-stemmed grasses are capable of holding the plant nutrients regardless of weather conditions. Native pastures of western Oklahoma which are well managed (properly stocked and weeds mowed) are capable of producing 75 to 100 pounds of beef per acre through the grazing season.

The native pastures of central and eastern Oklahoma consist primarily of the tall bunch grasses (big and little bluestem, Indian and switch) and are commonly known as soft-stemmed grasses. These species lose their plant nutrients very rapidly during late summer and fall through leaching. They are highly fibrous through the winter but do provide considerable feed if allowed to mature a seed crop.

One of the most important pasture management problems in all sections of Oklahoma is weed control. Most of our weed species are bitter and highly unpalatable. These weeds rob the grasses and legumes of soil moisture and plant food, and prevent them from receiving the necessary sunlight for proper growth. Weeds also are obstructions to uniform and efficient use of the palatable forage. Pasture burning will not control weeds. In fact, burning increases the weed population and decreases the grasses and legumes. It is highly important to plan and execute a weed-mowing and non-burning pasture program in Oklahoma if we expect to maintain efficient production of our pastures. In fact, many of our fine native tall grasses are rapidly disappearing in our pastures and may become extinct unless they are more carefully protected.

Another very serious pasture problem is that of soil fertility. It has heretofore been mentioned but is worthy of repetition. Most of our pastures in central and eastern Oklahoma are confined to the poorest soils. These soils are low in minerals, particularly calcium and phosphorus. Chemical analysis made by the Oklahoma Experiment Station shows that grasses grown on limestone soils are much higher in mineral content than grasses grown on sandstone soils. Pastures well supplied with minerals are more nutritious and palatable than those which lack them. Several experiment stations, particularly the Missouri Experiment Station, have proven that the "old cow," often called the "dumb brute" is smart enough to select pasture or hay which is grown in high mineral soils. Nature does a wonderful job of converting soil nutrients into complex chemical compounds and making them available and usable to the animal body for building bone, muscle and fat through plant life. We are not yet smart enough to duplicate this natural process through synthetics. It is also an established fact that cattle can stand knee-deep in green grass and literally starve to death. Sunshine and soil moisture may make lots of green herbage, but fertile soil, plus sunshine and moisture, is necessary in the production of nutrient feeds.



FOREST SERVICE ROUNDS OUT 40 YEARS

Congratulations go to the U. S. Forest Service, which celebrated its 40th anniversary on February 1. On that date Gifford Pinchot, visited the office of Lyle F. Watts, present chief of the Service, to take a look at some of the wood products developed and improved by Forest Service scientists. Mr. Pinchot, former governor of Pennsylvania, headed the Forest Service in 1905 when it was first set up under President Theodore Roosevelt.

The Soil Conservation Service has assisted farmers and ranchers with the construction of more than 21,500 ponds. Many of them are not primarily for fish production, being built especially for stock water and other purposes. Last year, however, 2,451 ponds, carefully stocked with 3,090,000 fish, were placed under specific management of a kind intended to provide continuing yields of about 250 pounds of fish per surface acre per year.

"A good job of contour farming, the planting of gullies, the revegetation of lands so steep that they should not be farmed, or a general program of building up or maintaining soil fertility, certainly will be reflected in increased wildlife populations." —Ira N. Gabrielson, director, Fish and Wildlife Service.

DISTRICT PROFILE

BILL ROPER, LANCASTER LEADER

Ask anyone who is familiar with the soil conservation movement in Pennsylvania to name the farmer who has done most to further soil conservation in the State, and the answer is pretty likely to be "Bill Roper."

Hartwell E. Roper is an outstanding conservation leader in an outstanding agricultural county, Pennsylvania's famed Lancaster. Moreover, his leadership is not confined to his home bailiwick or to the Lancaster Soil Conservation District. In Harrisburg, the state capitol, in Pennsylvania's five other districts, and in the portions of the state which have no districts, Bill Roper's knowledge of and profound belief in district philosophy and in soil conservation principles and practices, together with his modest but natural leadership, have proved invaluable in getting attention and action from fellow farmers, from civic leaders and from members of the legislature.

Bill Roper, was born in New Jersey and graduated from the Massachusetts State College in 1928, majoring in animal husbandry. After three years spent in travelling across the continent and working on farms in Massachusetts and Washington, he came to Lancaster county. He bought 122 acres of land, near Kirkwood, which would barely support a dozen head of cattle. For five years Roper worked his land in accordance with conventional farming methods. **By 1935 he had raised one of the biggest gullies in Lancaster county; it must have been 400 feet long, 20 feet wide and 10 feet deep, and it kept cutting back each year.** He was afraid the gully would cut his farm in two in a few years more, and he was disheartened about the outlook for the whole farm.

In 1936 the Soil Conservation Service was starting demonstration on Lancaster county farms, and Roper was one of the first farmers in the county to agree to undertake a soil conservation program. He balked at first at some parts of the plan which the Soil Conservation Service technicians prepared for him. In a very short time, however, he became thoroughly sold, not only on his own program, but on the whole conservation idea. In the spring of 1938 he was one of the 238 Lancaster farmers who voted for the establishment of a soil conservation district; and because even then his interest and

Hartwell E. Roper, chairman, Lancaster Soil Conservation District.

leadership in the district movement were beginning to be felt, he was made chairman of the board of district supervisors.

Roper has shown an almost uncanny knowledge of district philosophy as it relates to local people, to district governing bodies and to assisting agencies. He and the other district supervisors have been singularly successful in guiding the Lancaster district in group participation by farmers, supervisors and the staffs of cooperating agencies and organizations. As his influence and leadership grew, Roper unassumingly took over statewide responsibilities and tasks for which he was so peculiarly fitted. **On his own time and frequently at his own expense, he attended and spoke at meetings of farmers, of civic groups, and of legislators.**

(*Continued on page* 227)

FIGHTING SOIL EROSION IN BRITAIN'S COLONIES

Great efforts are being made to halt the drift of soil in Basutoland, Bechuanaland and Swaziland, where erosion is at its worst. Here a deep donga is being formed by water rushing down from overgrazed veld, through a road culvert and under a railway bridge. State roadmakers and railways, says the author, must cooperate with the farmers in fighting soil erosion.

By G. M. RODDAN

In Britain's colonial dependencies it is now increasingly realized that soil erosion has become progressively serious as the influence of the white man has spread. He brought peace, and skilled medical, agricultural and veterinary services were established. This led to increased human and animal populations, and the soil was called on to produce more food. Commercial interests saw to it that inducements were offered to increase production from the land of products surplus to the subsistence needs of the inhabitants. These influences have caused an increasing exploitation of Nature's resources and have brought in their wake the evils consequent on deforestation, insufficient resting or fallowing of cultivable land and overgrazing by the flocks and herds of the pastoralists.

When land is first opened up from natural forest or jungle the soil is of excellent structure. It is granular, has a high humus content, and is capable of absorbing and retaining a good supply of water. With each successive cultivation the structure is destroyed and the water-absorbing capacity reduced. The result is that more and more of the rainfall runs off the land, carrying with it the valuable smaller particles of soil and plant nutrients. After heavy rain we have all noticed how the rivers, streams and tiny brooks all run red and muddy. Soil is being moved. Many of Britain's dependencies are subject to torrential rains, and such downpours accentuate soil movement.

European government officers, traders and planters were trained under and accustomed to temperate climatic conditions. Bitter experience has shown them the rapidity with which deterioration and loss of soil take place under tropical downpours, soil-parching sunshine and prolonged droughts. Erosion is a most insidious evil because the early stages are not obvious to the inexperienced eye, and once the "squander bug" has gained a footing wastage proceeds rapidly.

In recent years the Colonial Agricultural, Forestry and Veterinary Departments have been fully

EDITOR'S NOTE.—The author is a Bachelor of Science and holder of the National Diploma in Agriculture; he has spent 12 years in Sierra Leone in swamp rice development as agricultural officer. This article is presented by courtesy of the British Information Services.

aware of the enemy in their camp. The first sign of erosion noticed may be loss of soil fertility. In the wet tropics, one is struck by the luxuriance of tropical vegetation and the apparent fertility of tropical soils. Experience soon shows that intrinsically such soils are poor. As the soil loses its fertility it also loses stability and is unable to maintain its position when attacked by the forces of nature.

In 1937 Sir Frank Stockdale, then agricultural adviser to Britain's Secretary of State for the Colonies, reviewed the position in regard to soil erosion in the various dependencies. Successive Secretaries of State for the Colonies have drawn the attention of colonial governments to the matter and have stressed the importance of regarding soil conservation as a matter of major policy having direct bearing on the welfare of the communities.

To assist Governments, the resources of which were insufficient to embark on conservation projects, the provision of grants from the Colonial Development and Welfare Fund was contemplated.

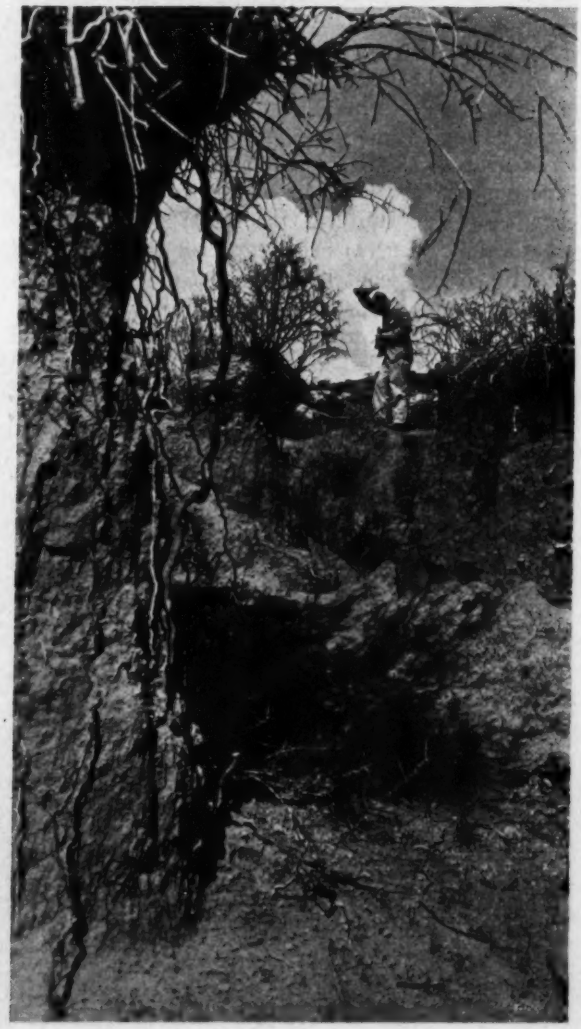
Although developments have to some extent been impeded by the shortage during wartime of staff, labor and equipment, the matter is under continuous review and marked progress has been made. The object of a soil conservation policy is two-fold—to repair and to prevent damage. This necessitates a revolution in many of the established native systems of agriculture and animal husbandry, though modifications are adapted to suit the ways and needs of the cultivators and pastoralists themselves. Soils and climate vary from colony to colony, and consequently it is necessary in each locality to ascertain by experiment the system best adapted to the conditions. The even more difficult task follows of securing the adoption of these systems by cultivators.

Much progress has been made in devising and in securing the adoption of systems of mixed farming aimed at maintaining the fertility of the soil, and incorporated in these systems are methods designed to counteract the dangers of erosion. As apprehension of the position grows, so willingness to co-operate increases.

In the dependencies the most widely prevalent form of erosion is sheet erosion, but in places ex-

Damage from soil erosion is most serious in the High Commission Territories of Swaziland, Bechuanaland and Basutoland. Excessive grazing and uncontrolled runoff of storm water have removed millions of tons of soil. This horrible example of erosion is on the town lands of Aliwal North.

Tree roots fight hard to bind the soil, but without a protective cloth of grass theirs is a losing battle. Trees alone cannot stop erosion.



tensive gullying also occurs, while in drier areas wind erosion is a serious menace. The chief contributory causes have been excessive deforestation, cultivation of hillsides which should never have been opened for cultivation at all, unsuitable methods of cultivation and the growing of crops conducive to erosion without adequate cultural safeguards, lack of protection from wind, and excessive concentrations of livestock leading to overtrampling and consequent soil loss.

Damage from soil erosion is most severe in the High Commission Territories (Swaziland, Bechuanaland and Basutoland) and in the East African dependencies. If somewhat less severe in West Africa, considerable damage has been done in the northern parts of Nigeria and the Gold Coast, and over-cultivation, particularly of hillsides, has left scars on the impoverished uplands in Sierra Leone.

The position varies greatly in the West Indies, but is very serious on the more mountainous islands. In Palestine and Cyprus too, erosion has reached an advanced stage.

Measures taken to repair and prevent the damage done by erosion may be grouped under three heads—(1) agricultural, (2) forestry and (3) mechanical. Under (1) are comprised ploughing and planting along contours, the use of grass strips and live wash-stops, the planting of windbreaks, the use of cover crops, the control of grass and bush burning, and the improvement and controlled grazing of pastures. Under (2) the establishment of forest reserves and reafforestation of denuded or threatened areas, and under (3) the construction of contour bunds, terraces, stops and dams for the checking of gully erosion, and the provision of wells and water supplies, thereby removing the need for concentration of human and livestock populations.

In Kenya a special soil conservation branch of the Department of Agriculture was instituted in 1938 and since that date by ordinance and rule the authorities have been given wide powers for the protection of the natural resources of the country. Surveys are being carried out to provide data for long term planning, and a considerable amount of protective work has already been done. This includes the construction of narrow-based terraces on 70,000 acres and live-wash-stops on over 17,000 acres in the Central Province in 1940; 200 grassed drainage ways were established. In 1941 some 2,200 miles of variable grade and contour lines were set out. And in Nyanza Province banks and trenches have been constructed to control erosion on 44,000 acres. Demonstration centers have been established, and around Msau the local native council have set aside large areas for reforestation.

In Uganda also considerable progress has been made. To ensure co-ordination of the various services, a Development and Welfare Committee was set up in 1940. Much attention has been paid to the control and protection of grazing grounds and to the provision of watering facilities for stock. A system of rotational grazing has been widely adopted, tsetse infested areas have been cleared, and the sale of stock organized. The area of reserved forest has been increased by some 380 square miles. In the cultivated areas the practice of strip cropping, whereby narrow grass strips are interposed between the cultivated contour strips, has been widely adopted and the people are really becoming erosion conscious.

In Tanganyika the active co-operation of the people has been obtained, and one of the features of the work in this territory is the organized tribal turnout of labor for conservation works. Thus, in the Central Province a 10-year program has been laid down which aims at controlling erosion on 5 million acres of pasture and 1 million acres of cultivated land. Large grazing areas have been reserved for use during the dry season. Hundreds of hilltops have been closed to cultivation, gullying has been controlled and many acres of communal fuel plantations planted up.

Further south in Northern Rhodesia, where the traditional system of millet cultivation involves the annual lopping of trees over a large area to provide material for burning on the cultivated patch, controlled rotational lopping has now replaced indiscriminate destruction. Strict control of burning is enforced. Whole villages, involving some 18,000 people, have been moved from impoverished areas and settled in an orderly manner in their new lands. Here the land for cultivation is laid out in blocks and between each block contour strips of vegetation are interposed.

Nyassaland received a free grant of $66,000 from the Colonial Development Fund in 1940 to assist in defraying the cost of anti-erosion measures. Surveys are now being conducted to determine areas suitable for settlement so that the pressure on over-worked land can be relieved. The relief of the congested areas is one of the main problems, and an administrative unit has been set up to determine in a practical way how the whole village life can be reconstructed so as to preserve the natural resources of the land.

Grass
comple
on the
to ger
grass

(*above*)

Grass will grow here again. As soon as a dam has been completed, indigenous thorn bushes are felled and placed on the silt flats to shade the soil and allow the grass seeds to germinate. In a year or two a protective covering of grass will cover the soil and regulate the flow of water.

This dam is in the Vlakpoort reclamation area. Leading methods of combating soil erosion in Basutoland, Bechuanaland and Swaziland include terracing, contour cultivation, prevention of gullying by planting grass and trees on contour banks, provision of water supplies, planting of fuel reserves, controlled grazing, fire control, and improved farming practices.

(*below*)

In Somaliland where the beneficial effect of the scanty rainfall is greatly reduced by desiccating winds the inhabitants are nearly 100 percent pastoralists. The population, both human and livestock, is tied to the few sources of water for the greater part of the year and such concentrations do immense damage. Surveys have been made and it is hoped to formulate a general grazing plan for the country.

In Basutoland, Bechuanaland and Swaziland erosion is a very serious problem but a great deal has been done to ameliorate the situation. To Basutoland was made available $640,000, to Bechuanaland $556,000, and to Swaziland $84,000 under the Colonial Development Fund. Excessive grazing and uncontrolled run-off of storm has removed millions of tons of soil from these territories. The main methods adopted to control this destruction are terracing, contour cultivation, the prevention of gullying by planting grass and trees on contour banks, the provision and protection of water supplies, the planting of fuel reserves, controlled grazing, fire control, and the introduction of improved farming practices.

Soil erosion is not so widespread in the West African dependencies, nor, in general, is it so far advanced. In the north of the Gold Coast and of Nigeria problems are similar to those of East Africa, and sheet and gully erosion and uncontrolled grazing and burning have led to soil degradation. The prevention of grass fires, the introduction of mixed farming, involving the increased use of farmyard manure, reforestation and the planting of fuel supplies are all measures aimed at conservation of natural resources. In Sierra Leone rice cultivation on river swamps and in valley bottoms is being fostered in order to relieve the pressure on the overworked uplands. To assist in implementing this policy, surveys were carried out, a grant and a loan of $1,212,000 was made under the Colonial Development and Welfare Act and experienced irrigation and drainage engineers engaged. The work is making progress.

In the Mediterranean and Eastern dependencies many of the countries are more highly developed and some of them, such as Malta and Palestine, have very ancient traditions and civilizations. The problem of soil erosion in such countries was recognized in ancient times, but many of the structures for control have been allowed to fall with disrepair. A determined move to remedy this lapse is now being made and soil conservation is well to the fore in the development policies of these territories. Irrigation and control of flood water receives much attention.

In the West Indies the gravity of the position varies greatly in the different dependencies. The subject has received much prominence in recent years and it can be claimed that public interest and awareness has been awakened. Great efforts are being made to devise and introduce farming practices which will maintain fertility and conserve the soil. Simple mechanical measures of soil conservation are being advocated. The rapidly increasing density of the population in many of these dependencies demands that the productivity of the land should be maintained at its maximum if a reasonable standard of living is to be assured to the inhabitants. By the means of propaganda, demonstration and legislation many forward strides have been taken. Contour cultivation, terracing, strip cropping and contour drainage are all being practiced, but each particular eroded area requires individual consideration and appropriate practical control measures.

Anti-erosion demonstration plots on hillsides are now giving yields greatly superior to those of the unprotected lands, and planters and native cultivators alike have been impressed by the results obtained and are copying the practices demonstrated. In all of the many land settlement schemes now in being, soil conservation receives great prominence. Agricultural staffs have been considerably augumented, officers for full-time employment in soil conservation have been appointed and long-term research on the problem is to be instituted.

Although soil erosion is still one of the main problems to be faced, it can be claimed with justifiable pride that despite the handicaps imposed by wartime conditions great progress in devising and applying soil conservation measures has been made in recent years. Funds provided by the Imperial Treasury through the Colonial Development and Welfare Fund have played no small part in making this progress possible. Of great importance too has been the awakening of public interest in this work, and in many territories the people are aware of, and have willingly accepted, the duty they owe to future generations of preserving their means of livelihood—the soil.

The 13,000,000 acres needing biology practices pose some problems upon which farmers and ranchers will need the help, not only of soil conservationists, but also of wildlife technicians and others. Some of the problems are of a community nature beyond the scope of the individual land operator. Among these are frequently those pertaining to streambank and spoilbank management.

FARM FORESTRY PROJECTS IN TIME OF WAR

The perfect crop for conserving water and preventing soil erosion. These trees are in a well-managed Maryland woodland.

By JOHN W. KELLER

Five years of operation of farm forestry projects were completed June 30, 1944. Only about half of the present projects were established during the first year. War seriously interfered with the continuity of administration, but the results in terms of demonstrating the place of woodlands in farm economy, have amply justified the initiation of the projects. This summary affords only a faint idea of the benefits derived because it will require at least another decade to build up growing stock in woodlands, records in the books, and new habits and philosophy toward the woods.

The Soil Conservation Service during the fiscal year 1944 was responsible for 46 farm forestry projects in 32 states. Each of these projects is a representative of a major farm forestry problem area. Seventy-five percent of the projects are located wholly or partially within soil conservation districts. Each is administered by a technically qualified forester who assists farmers in planning and applying, as a part of their farm business, woodland management operations suitable to the individual farm. Careful records are kept of the condition of the woodlands, the expenses incurred by the owner for labor, team, and equipment, the income from sales of wood products, the value of the wood products used on the farm, and other information indicative of what similar woodlands within the problem area should yield, and the importance of farm woodlands in the farm economy. These projects, in effect, are becoming more and more pilot plants for reinforcing the work of farm planners currently talking to farmers about the woodland as a farm enterprise. They need data on woodland values, income, and practices. They are interested in knowing how to solve marketing problems, and in new woods tools to help farmers cut more forest products. These things are the stock-in-trade of the farm foresters; these are subjects in which they are becoming experts.

Annual reports submitted by farm foresters for the fiscal year ending June 30, 1944 cover the activities of 41 projects. Five other projects are new and were without foresters for a large part

EDITOR'S NOTE.—The author is assistant chief, Forestry Division, Soil Conservation Service, Washington, D. C.

of the year. Due to the lack of qualified foresters, four projects that submitted reports were without foresters for six months or more during the fiscal year.

Administration of farm forestry projects is through the State Forester in cases where state funds are used to match federal funds in making up the annual budget and in such cases, farm foresters report to the State Foresters. In the absence of this cooperation, the entire budget is provided from federal funds and the farm foresters are responsible to the district conservationists of the Soil Conservation Service. Of 46 operating farm forestry projects, a total of 16 were administered by State Foresters and 30 were administered by the Soil Conservation Service. Thirty-four are located wholly or partially within soil conservation districts, and operate under the sponsorship of the district governing body. The average annual cost of administering a farm forestry project, including both federal and state funds, varied from $3,200 to $4,427. The federal government contributed $122,110; states and counties, $30,142. The states, therefore, advanced about 20 percent of the total operating costs of the projects. West Virginia leads in number of farm forestry projects, with four.

Complete farm plans for 389 farms embracing 99,118 acres, and woodland plans for 427 farm woodlands including 48,083 acres were written during the year. Only 40 out 427 tracts of woodland were planned separately from the farm. By including woodlands as a part of the farm and utilizing farm labor and equipment annually in harvesting wood products, the farmer secures maximum returns.

Two types of cooperators are assisted by farm foresters. Type I are those who have become cooperators because they are interested in growing, developing, and managing their woodlands as producing units of their farms and are willing to keep annual records to show the results of management. Over a period of years these detailed records will furnish data to show the value of farm woodlands to the farm economy. Type II are those concerned chiefly with the proper method of cutting and marketing of woodland products for sale, primarily to help the war effort. Farm and woodland plans are written only for Type I cooperators, and during the year 427 woodland plans were written. Assistance was requested of farm foresters by 1,090 woodland owners and help was given to 603 who became Type II cooperators. Their woodlands represent an area of 39,451 acres. The records show that 319 of these Type II cooperators carried

A Pennsylvania farmer working up his winter fuelwood with a Sandvik one-man saw.

on cutting operations on 20,924 acres in accordance with the farm forester's recommendation.

Assisting the war effort by getting the highest production of wood products was the most important activity of farm foresters during the year. War needs were so great that a large part of the farm forester's time was spent in urging farmers to carry on timber harvest operations and in assisting saw mill and woods operators to produce the maximum. Involved in this were such things as clearing through ration boards requests for truck tires and gasoline for hauling logs, securing deferment of woods labor through draft boards, arriving at interpretations of OPA instructions and regulations, working with T.P.W.P. personnel, War Boards, O.D.T. representatives, and other war-time agencies.

Principal wood products removed were logs, poles and piling, crossties, pulpwood, fence posts, and fuelwood. The total production by the 1,030 Type I and Type II cooperators amounted to approximately 35,000,000 board feet of logs and lumber, 280,000 linear feet of poles and piling, 300,000 feet of fence posts, 10,000 cords of pulpwood, and 27,000 cords of fuelwood.

Labor shortage was the greatest obstacle to expediting work on farm woodlands. At some locations, woods work was stopped and in most places it was retarded. Some farmers were compelled to purchase coal or buy fuelwood to meet domestic needs because they could not get fuelwood cut in farm woodlands. Still other farmers had to hire labor to cut fuelwood, and many farmers were forced to sell stumpage instead of processed products.

Cooperative organizations are encouraged by farm foresters in every practical way. These cooperatives are composed of local farmers who band together for fire protection, or to get the best prices. Four cooperatives organized within farm forestry projects were active during the year. The Holmes Creek Farm Forestry Cooperative in Florida, at the end of the third year, has a membership of 39, with a total of 4,137 acres of farm woodlands receiving fire protection. This cooperative has a two-ton fire truck, back-pack pumps, and other hand equipment suitable for fire control.

The Winona Wood Products Cooperative Association, Inc., in Minnesota, has a sawmill, milling equipment, and a power unit that may be moved from one location to another where farmers have their logs ready for processing. Farmers are being urged to produce more wood products to meet their own needs of both rough and finished farm grown timber.

Weber splitting gun before explosion. It is used on a Pennsylvania farm forestry project to split logs for easy handling.

The Turtle Mountain Woodland Products, Inc., in North Dakota, handled over 56,000 fence posts and 300 cords of fuelwood during an 8-month period last year. A year ago this cooperative declared a patronage dividend of 18 percent that was paid to 15 paid-up shareholders and 64 patrons, and the annual sales amounted to approximately $12,000 in addition to sizable stocks on hand. Equipment includes a 50-pound trip hammer, a 2-HP electric motor, two concrete post-treating tanks of 60-post capacity each, and similar equipment. This cooperative is now considering the purchase of a saw mill and is putting on a campaign to get more local lumber cut.

A saw mill cooperative in Idaho boasts that all members are farm forestry cooperators. They have a sawmill that is moved from community to community within the project area and farmers harvest and process woodland products, first for home use and later for sale.

New tools and equipment are introduced by farm foresters for saving labor in woods operations, and for speeding up production. Farm foresters on 16 of the 41 reporting farm forestry projects have introduced various types of power equipment, chain saws, Sandvik bow saws, Weber splitting guns, new types of wood burning stoves, logging equipment, log trailers, tree-planting machines, post-treating plants, poisons for killing stumps, etc. Farm foresters are keeping up to date in new developments affecting farm woodlands; tools, equipment, and materials that show promise are being tried in an effort to give farmers every possible advantage to prove that farm woodlands constitute an important part of the farm business.

Lump sum sales are discouraged by farm foresters, but unfortunately the annual reports are comparatively silent on the trends in the various localities. Seven projects report increases in stumpage sales because of lack of farm labor. Under war conditions it is difficult to get farmers to process their own wood products, derive the benefit of supervision of their own woods operations, and use farm labor that otherwise would not be fully used during the winter months. These are important factors in increasing returns from farm woodlands.

Educational activities require much of the farm forester's time. The annual reports show that 29 projects held forestry meetings and field trips, 14 farm foresters used the radio and local meetings to present the possibilities of farm woodlands, 17 farm foresters supplied local papers with news stories concerning the projects, and 9 farm foresters put on woodland exhibits at local fairs and other gatherings.

Except in a few localities, fire protection is not considered of major importance in the growing of products in farm woodlands; only 14 out of 41 projects report fire protection as a serious problem. While the leadership in the control of fires is recognized as the responsibility of the State Forester, farm forestry cooperators are shown the damaging results of forest fires and are trained in modern methods of fire prevention and control.

Net returns from farm woodlands vary greatly, as might be expected, due to wartime prices, locality, demand for labor in war industries, and the general condition of the woodlands. During

the year the returns per acre varied from 95 cents to $12.87, and farm labor earned from 56 cents to $2.44 per hour for wood work. The average net earnings amounted to $320 for each of the 509 farms, and a per acre income of $3.31. In the fiscal year 1943 net earnings amounted to $258 per farm and $2.47 per acre. It must be remembered that most farmers are still selling stumpage and therefore failing to get returns on labor, either as wages or as profits in selling processed products.

The fact that the average cut did not exceed 200 board feet, or about one-half cord per acre for all products converted to these units of measurement, will indicate to foresters that these farmers have not been cutting up to production capacity. In other words, $3.31 net income per acre does not begin to represent the full reward of woodland management.

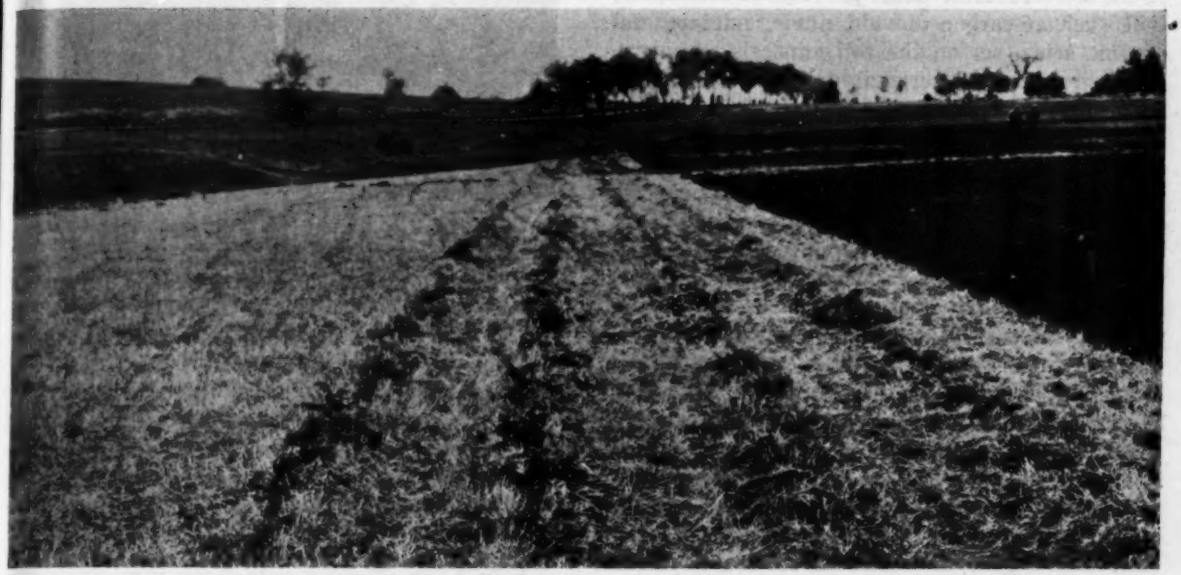
A tangible measure of the farm foresters' accomplishment is the production of the equivalent of 60 million board feet of wood products which was an outstanding contribution to the war effort. However, the intangibles add up to yet higher values: educational activities, record-keeping, convincing the farmer that the woodlands are part of the farm, building up woods appreciation, etc. These are the things that over a period of years will establish farm woodlands as important enterprises in the farm economy. While most of the accomplishments of farm forestry projects are in the field of farm economy, farm foresters, are not overlooking the part played by farm woodlands in the broader program of the Service. Trees are the perfect crop for the conservation of water and the prevention of soil erosion, and well managed farm woodlands play an important part in reaching the goal set by the Soil Conservation Service.

Returns from Managed Woodlands, Type I Cooperators, 1944

Project	No. of Farms	Woodlands under mgmt. (Acres)	Net Income		Total		Per Acre	
			Total	Per Acre	Converted to: Ft. BM	Cords	Converted to: Ft. BM	Cords
CF–1	40	7,097	$27,231	$3.83	235,700	5,885	333	.83[1]
2	33	4,950	16,597	3.35	833,755	2,200	168	.44[1]
Co–2	4	180	644	3.55	23,000	59	128	.33
Fla–1	11	1,239	3,421	2.76	310,335	776	252	.63
Ind–1	15	512	1,811	3.54	189,560	474	370	.93
2	34	1,123	6,122	5.44	278,400	696	248	.62
Ia–1	8	160	287	1.79	61,600	154	385	.96
Ka–1	29	703	5,665	8.06	290,000	727	412	1.03
La–1	27	2,826	4,077	1.44	357,600	894	126	.32
2	6	569	5,640	9.91	395,700	989	695	1.74
Md–1	12	612	600	.98	122,115	305	200	.50
Mich–1	35	873	4,928	5.64	229,550	574	260	.65
Minn–2	20	1,460	2,909	1.99	267,200	668	183	.46
Miss–2	37	5,108	10,780	2.11	906,326	2,266	177	.44
Neb–1	12	548	2,633	4.80	88,200	213	161	.39
ND–1	30	4,523	4,340	.95	415,000	1,037	92	.23
Ok–1	33	1,459	3,521	2.41	414,000	1,036	284	.71
Pa–1	36	2,845	36,606	12.87	1,398,179	720	491	1.26
SD–1	4	1,267	3,897	3.05	937,000	2,167	740	1.7
Tx–1	14	691	1,715	2.48	346,660	867	502	1.25
Va–1	41	8,114	8,491	1.05	941,369	2,354	116	.29
Wa–1	28	2,386	11,028	4.61	653,106	1,633	274	.69[1]
TOTALS								
1944	509	49,155	$162,943	$3.31	9,694,355	26,694	197	.54
1943	148	15,506	$38,371	$2.47	3,112,880	7,906	200	.51

[1] Cumulative to end of fiscal year 1944.

MICROBIOLOGY AND SOIL CONSERVATION



A conservation system of farming which uses crop residues on the surface of the soil to reduce runoff and erosion. Microorganisms perform their tasks of making plant food available under this plant-residue cover. (After Duley and Russell.)

By T. M. McCALLA

The soil is inherently a complex system composed of physical, chemical, and biological systems in a delicately balanced equilibrium. The bio-organic system is composed of 2 to 4 tons per acre of living plant material above the surface. Below the surface there may be as much as 4 tons per acre of living plant roots, ¼ to ½ tons of living microscopic forms, 30 to 60 tons of dead organic materials composed of the remains of higher plants, and bodies of microorganisms of all types and in all stages of decomposition. The biological system also includes non microscopic insects, rodents, and higher animal forms both living and dead. The bulk of the microbial activity is concentrated in the upper layers of the soil profile, where as many as one billion organisms may be present in a gram of soil. This represents the biological state of living and dead matter in a fertile soil.

The minute organisms, with the exception of a few groups like algae and autotrophic forms, depend upon the higher plants for fixed carbon. The higher plants, on the other hand, depend upon the lower forms to liberate carbon dioxide. The higher plants and the microorganisms are interdependent upon each other for the cyclic oxidation and reduction of carbon.

All of the nitrogen in the soil must be transformed to an available form by microorganisms. More than one-half of the phosphorus in eastern Nebraska soils is in an organic form and may be transformed by soil microorganisms to an inorganic form which is available to plants. Also, a part of the potassium and many other nutrient elements, such as sulfur, pass through the cycle of decomposition and resultant availability to the plant. These activities of the microorganisms are beneficial to the higher plants.

Most of the microscopic forms are competitive with crop plants for inorganic nutrients such as nitrates, oxygen, and moisture. Some of them cause plant diseases. Other living forms, such as insects, prey upon the crop plants. Worms and other animal forms are supported by the soil. Most of the microscopic forms, although competitive for food with the higher plants, play an important role in the release of nutrients from organic matter through decay. The microorganisms synthesize, as well as destroy, such compounds as the vitamins, hormones, and auximones in the soil and in plant material. Although it is not certain that these growth factors are required by higher plants from external sources, they are needed to various degrees by the different groups of microorganisms. During the release of the inorganic ions tied in organic complexes of plant tissue, the soil micro-

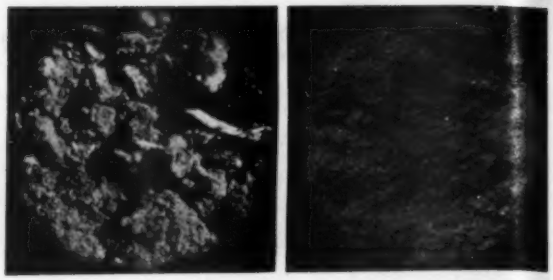
EDITOR'S NOTE.—The author is bacteriologist, Soil Conservation Service—Research, cooperating with the Nebraska Agricultural Experiment Station, Lincoln, Neb.

organisms liberate metastable decomposition products which are left in the soil to exert an influence on the soil structure. Other products of decomposition, such as carbon dioxide, nitric, sulfuric, and organic acids, act on the soil minerals causing a disintegration of the crystal structure and release the elements for plant use. In some soils, such as podsols, the organic acids developed during decay of plant residues have an important influence on the development of the soil profile. The presence of plant material in many different stages of decay in the soil profile has a pronounced effect on the physical and chemical properties of the soil and also upon the characterization of the soil. Many plants form a mycorrhizal relationship with the microorganisms that range from indispensable relationships with orchids and fungi to plants that derive no especial benefit from the association.

Accelerated erosion has resulted in a more rapid relative removal of the organic constituents than of the inorganic part of the soil. Soil erosion causes a removal of the microorganisms (see table) and organic matter which act as a fertilizer-converting and manufacturing plant as well as its source of material. The runoff water sifts out and leaves the inorganic fraction and takes a good part of the organic substances along to the seas. Soils of low fertility levels have a paucity of organisms. Before legumes will nodulate, lime or phosphorus, or both, and microorganisms, may need to be added to the soil. Raising the level of fertility by the addition of crop residues, manure, or fertilizers will usually result in a return of high microbial activity.

In a conservation program for the farm, all recommended methods of farming should be examined, as stubble mulch is now being evaluated, to determine what effect they are having on the function and performance of the biological system. The questions to be answered are. How do they effect soil structure? How do the practices affect numerous biological activities such as nitrogen fixation, nitrate production, denitrification, and other processes of nutrient production? It is of value to know how rapidly nitrification, for example, will proceed with a given system of soil conservation so that supplemental nitrogen such as inorganic fertilizer, manure, or a legume may be added if needed. It may be important to know the rapidity of conversion of organic phosphorus to a form available to the crop, so as to judge properly the fertilizer needs.

Generally, our farming practices have speeded up microbial activity so that the store of organic matter is dissipated at a more rapid rate than it



Structure in loessial soil. Left: surface soil containing organic matter. When it is protected with plant cover, residues or irrigated, it has a high intake rate. Right: Peorian loess (subsoil) at 10-foot depth, no organic matter. The percolation rate of this soil is low, regardless of whether it is sprinkled or irrigated without the beating action of water drops.

Total number of different organisms in the soil and in the runoff per gram of solid material for all plots, two seasons, the mean of 1935 and 1936. (After Wilson and Schubert.) Determination made by agar plate dilution method.

Number	Soil	Runoff
Ammonifiers	2,185,590	499,169,035
Nitrifiers	7,078	30,642
Sulfur oxidizers	76	2,434
Anaerobes	2,361	70,137
Cellulose bacteria	952	71,131
Legume bacteria	846	101
Fungi	195,333	18,731,810
Algae	3,279	321,335
All organisms	6,949,174	1,836,121,425

accumulates. Control over this type of microbial activity would seem desirable so that our store of organic matter could be conserved against loss by microbial dissipation through mineralization. Since microbial activity is responsive to temperature, moisture, fertility, tillage, aeration, and general management practices, it is possible to control friendly microbial activity by proper methods of tillage, drainage, fertilizers, crop rotation, and legume inoculation. Soil conservation methods should be adjusted so as to work with the natural biological performances in the soil.

During the decay of crop residues soil microorganisms and their products of decomposition play an important role in stabilizing the soil structure to water action. Both organic matter on the surface and in the soil have been found to increase water intake. Any solid organic material on the surface of the soil physically capable of breaking the impact of a falling raindrop will keep the surface from puddling and increase water intake. The organic matter, however, is subject to decay and

remains only until the organisms have broken it down into decomposition products too small to remain at the surface of the soil. Some constituents of organic matter in the soil do not increase soil structure stability under impact of water—it is only certain types of compounds. The lignins, waxes, fats, oils, and proteins were found effective, while cellulose, sugars, and starches did not affect stability. Microbial tissue, especially fungus mycelia, was an effective binder. The aggregate size, arrangement, and stability are important in water percolation. Cropping practices, such as a good rotation that includes a grass-legume sod, help to maintain the soil structure. The stability of the soil may be improved by the addition of manure or the return of crop residues.

Eroded fields may be restored in a considerable degree to their former productivity by the return of legumes to decay and produce nitrates, or by the addition of lime and phosphorus to make conditions more favorable both for the plant and the nitrogen-fixing organisms. Adequate soil fertility maintenance for insuring nodulation of the legume plant is necessary. However, lime and phosphorus application to an eroded soil may also speed up nitrification of the already depleted reserve of soil nitrogen, so that the production of leguminous crops is more essential than ever. The indispensable role of the legume bacteria in nitrogen fixation with legumes is unquestioned. The success of kudzu and numerous other leguminous cover crops in combating erosion is self-evident. Inoculation of legume seeds should be practiced where the soil is deficient in the proper legume bacteria.

Although plants may be grown without microorganisms, the fact remains that microorganisms are present in all soils. No soils are sterile. The most productive lands in this country are soils where the active biological complex is operating. Under these conditions, nutrients are released to the crop through orderly decay. The production of organic matter through plant growth allows the soluble nutrients in the soil to be tied up so they cannot be lost by leaching. The nutrients can be released later to the plants through decay. The growth of cover or green manure crops on bare land prevents erosion and also allows the plants to tie up available and soluble nutrients in organic complexes that can later be released by microorganisms through decay.

Erosion and certain cropping practices are rapidly depleting our fertile soils of their active biological system and the store of organic material upon which it functions. Our knowledge of plant growth and soil fertility is still limited largely to the inorganic phase. We may yet learn of the intricate mechanism in the surface soil—the biological complex functioning in a regulatory fashion. For example, during the winter the bio-organic system does not release nutrients in a soluble form to be leached away. When the weather is warm and conditions are favorable for crop growth, the biological system starts operating at a more rapid rate of nutrient development. This nutrient development may coincide closely with the plant needs, especially in a fertile surface soil. If there is nothing in the soil on which the biological system can operate, the system cannot function. Such a situation might arise in the case of an eroded soil.

It would seem evident that the best soil conservation procedures are needed, not only to conserve the better soils with this biological system, but they must work with it in accordance with natural laws.

Soil conservation appears, then, to be more than merely keeping the physical part of the soil in place. **A sound conservation program must include the best features of all good cultural and cropping practices developed on a firm scientific foundation, including the sound principles of soil microbiology.**

PROFILE—(*Continued from page* 215)

He wrote letters and made contacts. He championed the cause of an effective and democratic district law in Pennsylvania when certain groups in the state had other ideas. And because his wholehearted belief in and eagerness to fight for soil conservation and conservation districts has been tempered by a true tolerance and understanding, he has been willing to work with others whose views have differed from his. The whole soil conservation movement in Pennsylvania has been greatly furthered as a consequence.

Roper is not only chairman of the Lancaster district supervisors, he is also president of the Pennsylvania Land Conservation Association, a statewide organization which is interested in the conservation of natural resources for the general welfare of all the people in the state. In this capacity, he has had a further chance to show his leadership with the supervisors of all six districts in the state and with the whole membership of the Association.

What about his own farm? Somehow Bill Roper has found time to look after that, too. It has become a far different place than it was in 1936; here's one example. He has added 18 acres to the original 122, and has increased his farm's carrying capacity from 12 head of cattle to a herd of 50 purebred Guernseys for which he is noted.

E. Bioren Getze, Jr.

WISCONSIN DISTRICTS CONSIDER POST-WAR PERIOD

By ORRIE SHIFFER

Several weeks ago, I was one of 10 supervisors from about the state having the privilege of meeting here with representatives of the College of Agriculture and Soil Conservation Service. I was selected to represent the districts, to try and present their thoughts, which I believe will represent the thoughts of district supervisors throughout the state.

We read of post-war planning, we talk post-war planning, and I am pleased to state, we are taking action on post-war planning. Through our county boards, post-war plans are being developed. Municipalities are post-war planning. Our soil conservation district governing bodies have been developing post-war plans.

The more one studies the problem of soil erosion and land misuse and mismanagement, the more one realizes the size of the job to be done if we are to stabilize and maintain our soils. Wisconsin's wealth comes primarily from its soil. The welfare of its people, both rural and city, depends much on the way that soil is managed. Soil erosion problems are definitely an important part of all agricultural programs.

In Wisconsin as a whole, on 37 percent, or 3½ million acres of our cropland, soil erosion is a very minor problem. But on the other side of the picture we find that one-third of the cropland, or a little over 3 million acres, has lost about one-third of its original topsoil. On another one-fourth, or 2½ million acres, erosion has taken place to the extent that virtually all of the topsoil is gone. These figures should serve to arouse the interest of everyone in this problem, since we must remember that these tremendous losses have occurred over a very short period of time.

When we speak of soil erosion or soil conservation, we have in mind, of course, topsoil—that thin layer of the earth's surface which is so important for the production of crops and which is the foundation of agriculture. To bring home the importance of the topsoil, some yield tests were made by the Wisconsin Experiment Station and the Soil Conservation Service on selected farms throughout the state. Tests were made under actual farming conditions to determine yields for different depths of topsoil. Two plots were located on a single field so that the cropping history of the plots were identical. The slope of the land and soil type were the same—the only difference being in depth of topsoil. The results of these tests indicated that for about every inch of soil lost, there was a reduction in yield of about 3 bushels of corn and 3 bushels of grain per acre. That is, if one plot had 6 inches less topsoil than its check plot, a reduction in yield of about 20 bushels of both corn and grain resulted. If we were to multiply these yield differences by the topsoil losses, the figures would be startling. I believe that these results should substantiate the fact that we must keep our topsoil at home.

In Wisconsin, we have both water and wind erosion. The seriousness of each type varies in different sections. I believe it is safe to say that most all of the states land now covered by soil conservation districts is subject to water erosion and various sections are menaced by wind erosion, especially where the lighter soils are to be found.

As soil conservation district supervisors, we are gratified at the rapid progress made during the last few years in the conservation of soil and in the development of better land use. Let us consider a program for the future. We have upon several occasions met and talked about post-war planning and the problems involving erosion control which soil conservation districts are confronted with and which would be a worthwhile project for post-war work. It is now time that we at least set down some rather definite problems which exist, what it would take to solve the problem, and in general some proposals as to how such a program should be worked out.

There are many practices which are fundamental in a good soil conservation program, many of which can be done by farmers, either on their own or with technical advice and assistance. Many of these practices are being rapidly adopted by farmers in our districts, and we believe that they will spread at a rapid rate. Such practices as contouring, contour strip cropping, the use of better rotations and other similar ones, are proving their worth, and with a continued educational program and direct assistance to farmers, we feel that eventually most all farmers will accept this part of the program.

EDITOR'S NOTE.—The author is chairman, district supervisors, Eau Claire County (Wis.) Soil Conservation District. This article is a greatly condensed version of an address delivered by Mr. Shiffer at a two-day conference on post-war planning at the College of Agriculture, Madison, Wis.

Now let us think of the problems which have gone unsolved and which are, generally speaking, too big for the individual farmer to undertake. We often refer to these as "community type" problems, since not only the individual farmer, but groups of farmers and the community are affected. Since these are community problems, it seems apparent that the community is obligated to assist to a great extent in the solution. Much could be said about what these problems are and what it would take to bring about proper controls. For the purpose of this report, a few are listed with a few comments in regard to each.

1. *Major gully problems.* The control of large gullies involves the use of equipment, materials and labor which in the majority of cases are beyond the reach of the farmer on whose land the gully exists. In many of the districts, the control of such gullies is the No. 1 job. We believe the control is at least a partial public responsibility and that additional assistance to districts should be provided in order to help farmers on this type of job. These gullies, if not controlled, will not only destroy the land of the owner but will destroy land on other farms, highways, etc. Thus, the loss is to the entire community.

2. *Streambank erosion.* Again we have a large job confronting us, and here again the public is concerned. We need to stress the adoption of soil conservation practices on every acre in the watersheds that contribute to the stream. In both gully erosion and streambank erosion, many highways are involved, as well as other public properties which add to the importance of community action.

3. *Reforestation.* There are many acres of land which will serve the farmer and the nation best only when they are in forest. We therefore should have as an objective, the protection for forest purposes of all lands which are best suited for that purpose. Much labor and some materials are required. It is evident that this job is one which benefits the public and particularly future generations, in many cases to a great extent than it does the individual farmers.

4. *Drainage.* In some districts in the state there is much land of high capability which is poorly drained. This land should be brought into full production. By so doing, other land subject to severe erosion can be conserved and the more intensive cropping done on the other land if properly drained. Here again, most of such drainage jobs require community action. Along with such areas as need drainage we have the rehabilitation of old drainage ditches. Such a program involves ditch construction and tiling, and of course, heavy equipment and labor.

5. *Lime production.* During the past few years tremendous amounts of lime have been applied to our soils. However, a recent report indicates that over the state as a whole there are thousands of acres that have as yet never been limed. Conservation of soil and good crop production are dependent to a great extent on the lime applied to our soils. Therefore, we have the job, through the use of labor and equipment of providing the necessary lime to our farmers.

6. *Stone fences.* In some areas, particularly in eastern Wisconsin, it might be advisable to set up projects to provide assistance to farmers in the rearrangement of stone fences, getting them on the contour. This project would contribute materially to getting away from the old method of farming and allow for the adoption of contour operations. The job of moving stone fences in many cases is beyond the scope of the individual farmer. Equipment, especially, could be used to good advantage in this work.

7. *Water storage and flood control.* We have talked about the control of streambanks and major gullies, but we have, through the western part of the state, an advanced flood hazard. Floods are doing greater damage as time goes on not only on the big rivers but also on our smaller trout streams and small rivers. The tremendous damage done by floods not only to farmland but to towns, highways, railroads, lakes and other public property makes this problem one of vital concern to everyone. Since erosion is one of the prime factors, any soil conservation program should plan for water storage and flood control. Through public assistance to soil conservation districts, reservoirs could be constructed to impound water in the deep gorges in western Wisconsin. Such dams or reservoirs would not only serve as flood control measures but are necessary for the stabilization of eroding streambanks and active gullies.

8. *Sub-marginal land.* Some of the soil conservation districts include much land which is submarginal. The soil will not support a regular farming program. This land should come out of private ownership, developed for forestry or other purposes. Such a program would alleviate the substandard of living, would make a saving in the community as far as roads, schools and other services are concerned, and would allow for proper education and medical care for the people involved. It would remove the conditions which cause this land to become improvished. Soil conservation districts can assist zoning committees along this line and help carry out the program.

ASSISTANCE NEEDED

So much for a program. Now, then, to mention some assistance needed.

The solution to many of the problems outlined requires the use of many types of equipment. Some of the districts have a small amount of equipment made available through the Soil Conservation Service, and a much greater amount could be efficiently used as the program develops and we begin the solution to some of the bigger problems. It is recommended that any available equipment which becomes surplus and which could be used in soil conservation work, be obtained for soil conservation districts. This equipment, if obtained, should be allotted to the various districts as required and as best suited. The following types of equipment, and likely others, would be a primary need in putting across the program proposed:

1. Lime grinding equipment
2. Breaker plows
3. Bulldozers
4. Ditching machinery
5. Draglines and scrapers
6. Terracing equipment
7. Trucks
8. Cement mixers
9. Sod cutters
10. Small tools of various kinds, etc.
11. Cats—tractors
12. Wire

The program contemplated also will require labor, material, and last but not least, financing. We are not so much concerned whether this assistance is from the state or federal government, but it will be needed.

In closing, we feel soil conservation in the postwar era should be considered second only to health and safety.

On a farm near Worland, Wyo., a 5-acre seepy area not suitable for cultivation was diked for muskrat production. Two years later the owner trapped 75 muskrats on the few acres inundated, thus paying for the dike.

There are two general objectives of marsh management—production of furbearers, and production of waterfowl and other wildlife.

Soil conservation is a means of bringing the land and its management into equilibrium with environmental factors.

TRAMPLING OUT THE VINTAGE. By Joseph A. Cocannouer. University of Oklahoma Press. Norman. 945. $2.75.

Joseph Cocannouer, agriculturist and rural school teacher, has a message. He has nurtured this message deep in his heart for well over forty years, and it is written all over his new book, Trampling Out the Vintage. It is in the title, repeated in every chapter, written in English and American vernacular and quoted from the Chinese, the Dutch, and the Latin. His message is:

"Agriculture is the stabilizer of a nation. We must carry on a persistent, patient fight year after year towards the betterment of farm life, and society, both urban and rural, will have to be reeducated to turn its eyes back to the soil."

You won't be bored by the constant repetition of the theme, because it is woven into autobiographical sketches—tales that are reminiscent of over forty years of agricultural retrogression and progress, stories of life on the farm among the sandhills of Oklahoma, the scrupulously tilled fields of China, and the tropical rice paddies of the Philippines. There is a mixture, a refreshing mixture, of philosophy, folk-lore and superstition, and scientific methodology, with a generous dash of plain American practicality and ingenuity.

Like many another child of the soil, the author admits he grew old ahead of his years. While still very young, he was already analyzing, under the unplanned tutelage of his pioneer mother, the social and economic structure of the dwellers among the sandhills. He knew about the "cotton-thinkers" (those "who can't see a thing but a cotton stalk"), the "movin'-wagon farmers" (gypsy farmers, the riffraff of the cottonminds), and the "fly-by-nighters," who bled the land for all it was worth and then moved on. Much later in life he coined the term "pumpkin-minded," the full import of which will be clear only after reading his chapter on the pumpkin-that-grew-in-the-brambles.

After an apprenticeship in Oklahoma A. and M., Mr. Cocannouer determined to move heaven and earth if necessary to spread his gospel of better living and better farming. His streak of practicality served him well. He inched his way into the outer fringe of acceptance by treating sick cows, feeding unruly calves, and hinting to his Friday afternon "nature study" class about the value of

manure as a fertilizer. But the rural school teacher of the sandhills found his public inert to the new agriculture, and he yielded to the impulse to move on toward greener pastures. It is something to conjecture as to what might have developed had he applied the same pertinacity and ingenuity he used to install a huge hydraulic ram in the deep canyons of the Philippines to ferreting out ways of turning his own homeland into green pastures.

Mr. Cocannouer's down-to-earth reactions will no doubt arouse a sympathetic note in the hearts of other agriculturists and bring a smile to the lips of the budget-pleaders. His words are still heavy with sarcasm when he recalls the emasculation by the English Department of his textbook on corn and the substitution of sprightly, poetry-studded gems for his realistic prose. Then there was the time when he wangled a "suitable" appropriation from a recalcitrant government official by staging a fleeting, but gaudy show, including a feast of lush foreign vegetables in a dilapidated classroom in Manila. And there was the canny way with which he chose, or rather inveigled, the community leaders (those who could and would do the most good for the program) into turning their farms into demonstration projects of the new agriculture.

In his closing chapter, the author again summarizes his case on education for better farming. You may not agree with his prognosis that we still are floundering "despite what would seem to be a sincere effort on the part of the government to find a solution to the problems pertaining to the soil." But he implements his case well when he graphically describes the disillusionment and disappointment of the hill farmers after their soil has washed away to distant rivers, with nothing to rebuild upon except the ashes of neglect.

Verna C. Mohagen.

BENNETT'S SOUTHERN PLATFORM

In announcing Hugh Hammond Bennett as its annual choice for "Man of the Year in Service to Southern Agriculture," the Progressive Farmer recently presented Dr. Bennett's "Southern soil conservation platform" to its readers. This platform runs as follows:

1. *A better Southern farming system* including especially (a) better-planned rotations, (b) less land in row crops, and (c) a better balance between crops and livestock.

2. *Cooperate with Nature and Almighty* by making your crops fit your land and the shape of your land instead of trying to make the land fit your crops. Primarily this means (a) your most level land for row crops, (b) moderately steep slopes for grass and grain, and (c) all very steep slopes kept in trees or grass.

3. *Contour farming* is another form of cooperation necessary to save soils. Straight-line plowing on a sloping country defies Nature and invites disaster.

4. *Grow soil-holding and soil-building crops with or after all soil-robbing crops* with a constant effort to have two-thirds as much green land in winter as summer. The slogan "The South Will Come Into Its Own When Its Fields are Green in Winter" deserves constant emphasis.

5. *Adequate high-quality terracing* with constant emphasis on quality. A poor terrace may do more harm than good. Erosion is just as bad when caused by a terrace break or by too widely spaced terraces as when caused by having no terraces at all. And "Make the Water Walk Off, Not Run Off, the Land" must be constantly preached.

6. *Strip-cropping* to control erosion is newer than terracing but easier to do and should be just as generally practiced on adaptable land-long, gentle slopes.

7. *A vegetative mulch* on the soil-surface is a great help in saving land.

8. *Kudzu, crotalaria, sericea lespedeza and common lespedeza* are "The Big Four" among crops for saving and improving Southern soils—kudzu, among other purposes, to save gullying land, sericea to check sheet erosion, crotalaria to build and hold sandy soils, annual lespedeza to build and hold other soils.

9. *To drain too-wet land* is just as much soil conservation as increasing moisture-holding on too-dry land.

10. *Nearly all soil-conservation work is more effective* if done in cooperation with one's neighbors. Join in activities of your soil conservation district and in boosting erosion control as a No. 1 necessity for all Southern farm progress.

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